1:Beaglehole and Beaglehole E-5 (1934-5) 1938 Pukapukans

the voyagers made their departure from Nassau Island, they would fetch up within sight of Olosenga.

In sailing to the Gilbert-Ellice Islands, informants state that the navigators used Altair (Tolu). Sailing from Pukapuka, almost any course between 277° and 300° would take a canoe to a point close to one of the islands in the Ellice or the Gilbert groups. A course by Altair at setting is equal to 279°. As it rises higher in the sky its bearing swings to the north. It is visible at setting during the latter half of the trade-wind season when the weather is favorable for the voyage.

In voyaging from Samoa to Pukapuka, the Pukapukan navigators sailed from Upolu to Olosenga; then sailed on to Pukapuka using ζ, ϵ, and δ Orionis (Te Tolunga-Maui) as their star course. These stars would give a course of 88°, while the true course is 84°, and by taking from Traverse Tables under 4° (the difference between the true and the star course), and with the distance at 259 miles, one finds that the star course would put a canoe 18 miles to the south of Pukapuka. This is approximately at Tima Reef, which place would give a new point of departure for the canoe for the rest of the voyage. In case the canoe missed Tima Reef, due to bad steering or cloudy weather, it would still be likely to come within sight of Nassau or Pukapuka; and even if it missed all three landfalls, it could scarcely fail to come within a point 30 miles to the north or south of one of the islands, which point would be within sea-flight of the white terns—the sign of land. Hence, in sailing from Olosenga to Pukapuka, a distance of 259 miles, the navigator has a cross section of ocean, lying at 45° angle to his course, 110 miles long, in which to make his landfall.

Stress is laid on this point, for, to a casual observer, it seems little short of miraculous for a canoe to pick up a tiny atoll in mid-ocean. As a matter of fact, in the above case, it would be remarkable if the voyagers missed one of the two islands or Tima Reef.

Finally, the Orion's Belt course from Olosenga to Pukapuka is peculiarly advantageous as these stars are visible to eastward during the early part of the hurricane season when the winds are favorable for the return voyage. Later in the hurricane season—February and March—the winds are also westerly, but it is doubtful if a canoe would attempt the return voyage during these stormy months and, moreover, Orion's Belt would be too high in the sky to be used as a bearing. It is most likely that the return voyage would be made in December, when the winds are light from the west and Orion's Belt is low in the sky to eastward at sunset.

COUNTS AND MEASURES

The Pukapukan system of counting follows the general Polynesian system. It shows a high development of number prefixes used when counting different classes of objects. The list of numerals is:

1. Tayi	20. Lau lua
2. Lua	30. Lau tolu
3. Tolu	100. Lau
4. Wa	101. Lau ma tayi
5. Lima	111. Lau ma laungaulu ma tayi
6. Ono	200. Lua lau
7. Witu	300. Tolunga lau
8. Valu	400. Wanga lau
9. Iva	1000. Mano
10. Katoa or laungaulu	2000. Lua mano
11. Laungaulu ma tayi	10,000(?). Tini
12. Laungaulu ma lua	100,000(?). Ngaulu tini

1:Beaglehole and Beaglehole E-5 (1934-5) 1938 Pukapukans

802 193 The word *katoa* is used for ten in simple enumeration. It is never used in conjunction with the name of the object enumerated, but in its place *launganlu* is used. Where the special counting prefixes are used, these are added to the suffix *ngaulu* to indicate 10 objects of whatever class.

802 192 Numbers higher than *ngaulu tini* in progression of numerical greatness are: *manomano muamua, matinitini, makelekele,* and *ye,* which is an expression that corresponds to infinity. The number of terms that the Pukapukan uses to indicate high numbers is interesting though it is a little hard to see the function of high numerical concepts in an atoll culture.

It was a favorite jest among informants that the Pukapukan could count to a higher power than we could; proof of this they argued was not only the presence of words indicating progressions to infinity, but also the ability of the culture hero Maui to find Pukapukan words which enabled him completely to enumerate the stars in the sky, the fish in the sea, the sands on the beach, and so forth. It is likely, however, that such words as *tini, ngaulu tini, manomano muamua* indicate not so much a definite number as a progression of increasing greatness that is more sensed or felt than definitely apprehended.

802 193 To indicate "more than" or "plus" to even numerals, *tu ma* is suffixed to the numeral: some 70 people (*tinowitu tu ma*). To form numerical nouns from the numerals 1 to 10, *ngawa* is suffixed to the number: I have received my three (*na maua toku tolungawa*). Each is *taki*; one person or object each: *takitayi.* The prefix *tokitaki tu* is used of things to indicate "one by one", "one at a time", and so forth: *tokitaki tu tayi, tokitaki tu lua*; of people the prefix *takitau* is used: *takitau tokalua,* by twos, or, for each pair.

802 192 To count is *kaui or wakalau.* A special set of terms is used to count coconuts by pairs (*oaniu*). One pair of drinking or mature nuts is *tayi oaniu.* From this on the counting runs:

Lua: 4 nuts.
Tolu: 6 nuts.
Wa: 8 nuts.
Yepulupulu: 10 nuts.
Ono: 12 nuts.
Witu: 14 nuts.
Valu: 16 nuts.
Iva: 18 nuts.
Yaea: 20 nuts.
Tolu: 30 nuts.
Wa: 40 nuts.
Lima: 50 nuts.
Lau: 100 nuts.

802 193 The development of counting prefixes is indicated by the following list. To count people, the prefixes are:

Toka, counting people from 1 to 10: e tokatolu tatou, we are three.
Tino, counting people from 10 upward: tinongaulu, 10; tinowelau, 100 people.
Matino, used solely for counting the priest members of a god house (*wale atua*): matinotolu, three priests; matinowitu, 7 priests.

Inanimate objects or creatures other than human beings are counted with the following prefixes:

1;Beaglehole and Beaglehole E-5 (1934-5) 1938 Pukapukan

802
193

Ipu, coconut shells: ipungaulu, 10; ipulua, 20; ipuwelau, 100; ipuluangalau, 200.
Kai, fishhooks, used when counting the number of hooks on a composite fishing apparatus (taumakoenako): kailima, 5 hooks. The number of fish caught with this apparatus is also counted with the prefix kai, as kailima ika, 5 fish.
Kau, oven stones, fishline sinkers, leaves of prepared pandanus for plaiting: kaulua, 20; kauwelau, 100; kautolungalau, 300.
Kaui, fishhooks stored in the special tuluma receptacle, or hooks on a bonito trolling rod: kauitolu, 3 bonito hooks.
Kupu, plaited objects such as mats, hats: kupungaulu, 10; kupulua, 20; kupuwelau, 100.
Lau, fish caught by ordinary methods, or live fish: laungaulu, 10; lau lua, 20; lau, 100.
Manga, branches, livers (internal organs), bananas, or fingers: mangangaulu, 10.
Mata, talo, or pulaka: matangaulu, 10 tubers; matalua, 20; matawelau, 100 tubers.
Mata, meshes in a net: mataluangalau, 200 meshes.
Tua, crayfish or crabs: tuangaulu, 10 crayfish; tualua, 20; tuawelau, 100.
Ua, shellfish; uangaulu, 10 clams; ualua, 20.
Ulu, victories in a progressive game: ulutolu, 3 wins in disc-throwing game (tupe).
Yeka, canoe seats: yekatoro, 6-seater canoe.

These counting prefixes are also used in questions inquiring the number counted, as: *E tinowea te tangata?* How many people? *E matowea te taro?* How many talo corms? *E yekawea te vaka?* How big is the canoe? The answer uses the prefixes as given above.

804 Measurements of length are commonly used for fishlines, or in craft activities. Those in common usage are:

Watinga tangatanga lima: length of one finger joint, tip of finger to first joint.
Lua watinga mangamanga lima: two finger joints.
Tolu watinga mangatuanga lima: three finger joints, i.e., one finger length.
Ngawa mangahanga lima: span of hand from thumb to longest finger.
Watinga lima: finger tip to elbow joint.
Lima: finger tip to shoulder of outstretched arm.
Uma: finger tip to center of chest with outstretched arm.
Ngawa: tip to tip of fingers, with outstretched arms, across chest; tolunga ngawa, three lengths, and so forth.
Kauni: a length of 10 ngawa.
Lau: 100 ngawa: E wea te loa o te mea la? E lau; What is the length? 100 ngawa.

Measures of volume are made by the use of descriptive terms:

Mo naa lewu: a very little.
Lewu: a little.
Mo naa: a little more.
To ki: (a container) about ¼ full.
To kiki: between ¼ and ½ full.
To kiki ki lolotoua: about ¾ full.
Ki: full.
Ki kalala: brimful.
Ki kalalala: full to flowing over.

There are no standardized measures for volume; the liquid which is being described is added to the descriptive term to make clear the amount of liquid measured.